THE ONTARIO WATER RESOURCES COMMISSION

A

SUMMARY REPORT

OF

ARSENIC LEVELS

FOUND IN THE

MOIRA RIVER WATERSHED

April 1970

DIVISION OF INDUSTRIAL WASTES

Provincial Guidelines for Arsenic Levels in Water Supplies

Arsenic Content mg/l.	Comments
Less than 0.05	Suitable for drinking water. Water containin up to this level may be permitted for continuous use for all purposes eg., domestic supplies. In my opinion short-term fluctuations may be permitted above this level. As a guide the fluctuations should not exceed three times this limit and should not persist any longer than 30 days in any 6 months period.
0.05 - 0.2	For summer camp use and for summer cottagers, the desirable level would still be 0.05 mg/l. In my opinion short-term consumption of levels up to 0.2 may be permitted for periods of 2 to 8 weeks by summer cottagers and campers.
1.0	Water containing this level should be rejected for human consumption.

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INTRODUCTION

The Ontario Department of Health, the Deloro Smelting and Refining Company Limited, and the Ontario Water Resources Commission have all analysed samples from the Moira River for arsenic. The results are compiled in this report and an effort is made to interpret the data collected.

SAMPLING AND ANALYSIS

During the period 1951 - 1957, the only samples taken of the Moira River were those collected and analysed for arsenic by the Ontario Department of Health (ODH). In 1958, when a cattle kill was reported, the Ontario Water Resources Commission commenced its present sampling programme. In 1960, the Company started to report its analysis on samples collected and analysed in its laboratories. It had been the practice of the Company to take duplicate samples for comparitive purposes whenever the two Government organizations made a survey.

The samples which are submitted to the OWRC laboratories in Toronto are analysed by a modified Guitzeit method in accordance with the procedures described in "Standard Methods for the Examination of Water and Wastewater", 12th edition. Results are reported as milligrams per litre As and are accurate to ± 0.01 mg/l. Those samples which are sent to the ODH laboratories in Toronto are analysed by the Silver Salt method. These are reported as milligrams per litre As_2O_3 and have an accuracy of ± 0.05 mg/l.

During the past 8 years the Moira River at the plant site has been sampled on an average of 26 days per year by the three organizations concerned. Over the same period, the OWRC has obtained samples on an average of 17 days per year.

Routine monitoring of the water quality in the Moira River system is carried out by the Water Quality Surveys Branch of the Commission. The sampling points in this programme are shown in the appended map.

RESULTS

The results for the samples collected from the Moira River above the abandoned plant site and downstream at Highway #7 are tabulated in Appendix I. Also included in Appendix I is a summary of the annual average concentrations at these points.

The results for all sampling points on the Moira River system are summarized on a monthly basis in Appendix II.

The frequency at which samples are collected from the Moira River is greatest during the summer and fall when the arsenic concentrations are highest. Thus calculating a straight average of the results would give an unrepresentative average. In order to determine a more representative yearly average, the results were first averaged monthly and these monthly averages were used in determining an annual average. The annual average concentrations calculated in this manner are shown in Table I. Also, the annual average concentrations in the Moira River above the abandoned plant site and at Highway #7 are plotted in Graph #1 along with the annual average stream flow at Deloro.

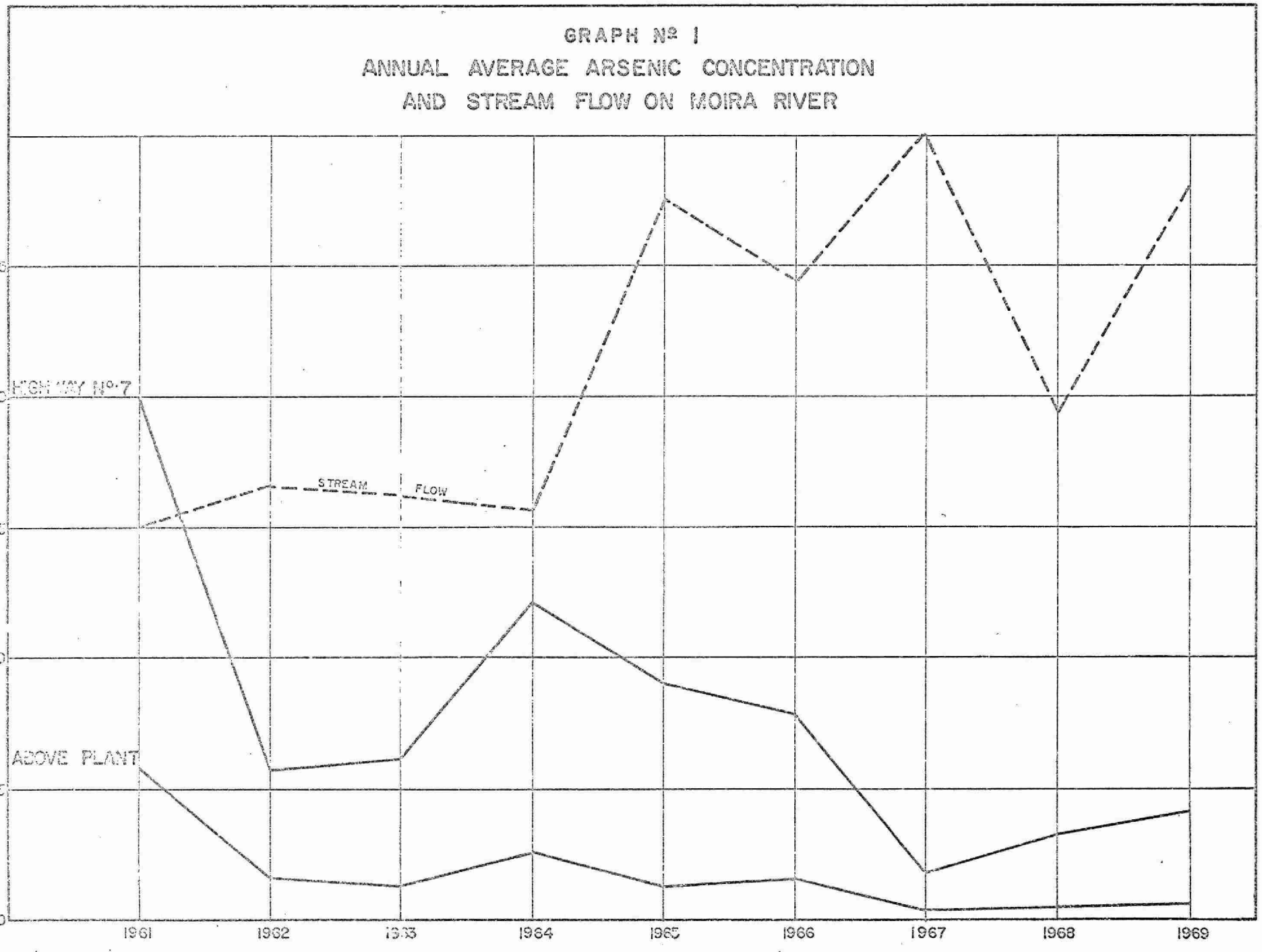
GRAPH Nº 1
ANNUAL AVERAGE ARSENIC CONCENTRATION
AND STREAM FLOW ON MOIRA RIVER
HIGHWAY Nº 7
ABOVE PLANT
STREAM FLOW
2·5
2·0
1·5
1·0
·5
0
150
125
100
75
FLOW AT DELORO — C.F.S.
1961
1962
1963
1964
1965
1966
1967
1968
1969

TABLE I

Miles from Bay of Quinte	1964	1965	1966	1967	1968	1969
.7	-	-	-	-	.01	.03
3.9	-	-	-	-	.01	.03
27.2	-	-	-	.01	.01	.04
29.7	-	-	-	.01	.02	.04
31.0	-	-	-	-	-	.04
31.2	-	-	-	-	.01	.03
44.4	-	.08	-	-	.10	.13
57.6	1.21	.91	.79	.18	.34	.42
58.7	.27	.13	.17	.03	.05	.07

RIVER FLOWS AND ARSENIC LOADINGS

The yearly mean river flow in the Moira River at Deloro has remained within 75 - 151 cfs. Flows as low as 0.3 cfs. and as high as 1150 cfs. have been recorded at Deloro since the stream gauging station was intalled in October 1965. River flows at Deloro between 1959 and 1965 were estimated by extrapolation using the reocrded flows at Foxboro and the ratio of the flows at Deloro and Foxboro from October 1965 until the present.

The arsenic loadings were calculated by using the concentration and flow on the day of sampling and averaging the loadings thus determined on a monthly and then yearly basis. These loadings are shown in Table II.

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TABLE II

ARSENIC LOADINGS

(LBS/DAY)

MONTH	1965		1966		1967		1968		1969	
	Above Plant	Hwy. #7	Above Plant	Hwy. #7	Above Plant	Hwy. #7	Above Plant	Hwy. #7	Above Plant	Hwy. #7
January	-	-	0	84	10	10	-	28	0	-
February	-	-	22	74	23	35	3	27	0	41
March	-	-	21	184	11	70	0	264	0	19
April	-	-	0	84	8	175	5	305	0	146
May	-	-	18	73	5	206	8	37	63	292
June	-	-	4	27	0	83	6	115	10	74
July	-	-	3	6	3	33	2	43	4	20
August	-	-	1	8	3	13	3	25	7	51
September	-	-	3	7	2	11	9	111	2	14
October	172	343	1	4	-	8	4	15	4	17
November	0	50	10	71	0	208	8	67	0	192
December	13	264	0	215	0	0	-	-	10	194
AVERAGE			7	70	5	70	5	94	8	96
AVERAGE INCREASE			63		65		89		88	

DISCUSSION OF RESULTS

The general trend of the arsenic concentration in the river both above the abandoned plant site and at Highway #7 has been towards lower levels. This may in part be due to the higher stream flows which occurred during the same period.

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Arsenic occurs naturally in the Moira River as is indicated by its presence as far upstream from the plant site as Malone in concentrations as high as 0.03 ppm. Over the past 9 years at a point just above the abandoned plant site an average yearly concentration of 0.21 ppm has been observed. However, the values obtained over the past 3 years have been considerably lower averaging 0.06 ppm.

The arsenic concentration in the river rises considerably in passing through the abandoned plant site as is evidenced by the samples collected at Highway #7. The 9 year average concentration at Highway #7 (M-57.6) is 0.85 ppm, but the concentrations at this point during the past 3 years have also dropped considerably, the average being 0.31 ppm.

In the 13.2 river miles downstream of Highway #7 (M-57.6) to the brdige on Moira Lake (M-44.4) the arsenic concentration drops to an average value of 0.12 ppm.

The Skootamatta and Black Rivers join the Moira River about 1 and 1.3 miles downstream of Moira Lake. The concentration of arsenic in the Moira River downstream of these influents remains within the OWRC drinking water quality objective.

A part of the reduction noted at Highway #7 between 1966 and 1967 is believed to have resulted from the installation of the waste treatment works by Deloro Smelting and Refining Company Limited and placed in operation in late 1966. These works treat the water flowing in the New Westerly Creek which picks up contaminated ground water from the

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abandoned plant site. Arsenic is precipitated by the addition of ferrous sulphate and then settled out in ponds.

Trenches were dug by the Company in 1969 to try to locate other sources of arsenic contaminated ground water gaining access to the river. Two flows believed to contain in the order of 20 to 40 lbs/day of arsenic were intercepted. These were directed to the treatment works in the latter part of the year. Insufficient data has been collected to date to determine if the treatment of these contaminated ground water streams will have a significant effect on the concentration in the river.

The programme of intercepting contaminated ground water streams for diversion to the waste treatment works is to continue in 1970.

CONCLUSIONS

The annual average concentration of arsenic in Moira Lake has been found to be in the order of 0.12 ppm or two to three times the maximum recommended in the OWRC drinking water quality objectives. It is hoped that the concentration can be reduced to less than 0.05 ppm with the present programme being carried out by Deloro Smelting and Refining Company Limited of intercepting contaminated ground water streams and directing these to the waste treatment works. It is expected that this programme will be completed this summer.

A P P E N D I X I

A Tabulation of All Arsenic Results for Samples Collected From the Moira River Above the Plant Site and at Highway #7

ARSENIC AS As (PPM)

ABOVE PLANT — HIGHWAY # 7

DATE	OWRC	DELORO	HEALTH	OWRC	DELORO	HEALTH
1951			.02			.28
1952			.02			.27
1953			.13			.04
1954			0			.03
1955			.01			.02
1956			.01			.05
1957			.01			.01
1958	.17*		.32	1.79*		2.01
1959	.02*		.29	.26*		.98
1960	1.2*		.78	2.67*		.54
1961	.58	.54	.37	2.01	1.43	.87
1962	.16	.27	.40	.57	.74	.17
1963	.13	.17	.04	.62	.62	.19
1964	.27	.35	.35	1.21	1.53	.57
1965	.13	.10	.03	.91	.79	.12
1966	.17	.18	.22	.79	.58	.88
1967	.03		.04	.18		.18
1968	.05		.09	.34		.29
1969	.07	.11		.42		.58

* - Less than 5 samples taken

ARSENIC AS As (PPM)

1969 ABOVE PLANT ——— HIGHWAY # 7

DATE	OWRC	DELORO	HEALTH	OWRC	DELORO	HEALTH
Jan. 26		0				
Feb. 17				.08		
Mar. 14				.06		
Apr. 13	0	0		.02	.06	
Apr. 22				.08		
May 25	.03	0		.14	.16	
June 9	.02			.22		
June 18				.14		
June 22	.02	0		.08	.10	
July 6	.02	.02		.11	.16	
July 15				.18		
July 15				.18		
Aug. 10	.09	.06		.53	.64	
Aug. 19	.10			1.00		
Aug. 19				1.00		
Sept. 2	.11			.47		
Sept. 7	.26	.36		1.44	1.50	
Sept. 23				1.52		
Sept. 29	.04			1.36		
Oct. 5	.52	.64		1.60	1.80	
Oct. 7				1.60		
Oct. 21				.47		
Nov. 29		0			.52	
Dec. 14		0			.32	
Dec. 21	.02			.18		

ARSENIC AS As (PPM)

1968 ABOVE PLANT HIGHWAY # 7

DATE	OWRC	DELORO	HEALTH	OWRC	DELORO	HEALTH
Jan. 21				.08		
Feb. 13	0			--		
Feb. 25	0			.07		
Feb. 26	.02					
Mar. 18	0		.04	.54		.17
Mar. 31	0		.08	.04		.08
Apr. 2				.04		
Apr. 14	0		.08	.04		.08
Apr. 28	.02			.21		
May 3				.09		
May 12	.02		.03	.06		.20
June 4				.49		
June 9	.02		.08	.02		.20
July 3				.06		
July 11	.01			.40		
July 21	.01			.20		
Aug. 7				.54		
Aug. 17	.15			1.40		
Sept. 7				.88		
Sept. 15	.09			1.00		
Oct. 13	.16		.20	.56		1.06
Nov. 10	.03		.12	.14		.23
Nov. 25				.29		

ARSENIC AS As (PPM)

1967 ABOVE PLANT HIGHWAY # 7

DATE	OWRC	DELORO	HEALTH	OWRC	DELORO	HEALTH
Jan. 15			.03			.03
Feb. 14			.04	.06		.20
Mar. 12	.02			.13		
Apr. 9	0		.03	.05		.16
Apr. 20	.01			.10		
Apr. 23	0			0		
May 7	.01		.08	.15		.20
May 21	0			.23		
June 4	0			.10		
June 12			.03			.32
June 13	0			.20		
June 18	0			.58		
July 16	.01			.11		
Aug. 13	.09			.30		
Aug. 27	.10			.67		
Sept. 10	.08			.42		
Oct. 2				.01		
Oct. 26	2.5			1.0		
Nov. 1				.22		
Nov. 12	0			.12		
Nov. 26	0			.05		
Dec. 5				0		
Dec. 10	0			0		

ARSENIC AS As (PPM)

1966 ABOVE PLANT ——————— HIGHWAY # 7

DATE	OWRC	DELORO	HEALTH	OWRC	DELORO	HEALTH
Jan. 9		0	.04		.75	.05
Feb. 13	.03	0		.10	.21	
Mar. 13	.02	0	.02	.18	.15	.24
Apr. 3		0			.12	
Apr. 17	0	0	.03	.07	.05	.04
May 5	0	0	.04	.03	.03	.08
May 22	.02	0		.07	.06	
June 1	0	0	.03	.03	.05	.03
June 19	.04	0		.20	.21	
July 3	.08	.15		.20	.38	
July 17	.20	.18		.28	.45	
Aug. 2				2.5		
Aug. 7	.32	.53		1.50	.95	
Aug. 21	1.0	.90	.67	2.0	1.36	1.58
Sept. 4	.8	.60	.67	2.3	1.50	1.67
Sept. 18	.53	.60		1.8	1.80	
Oct. 9	.40	.75	.51	2.0	1.67	1.65
Oct. 13	.32	.75		2.0	1.80	
Nov. 6	.10	.11	.20	2.1	1.80	3.35
Nov. 19	.04	0		.25	.18	
Dec. 4	0	0	.03	.10	.15	.12
Dec. 18	0	0		.13	.15	

ARSENIC AS As (PPM)

1965 ABOVE PLANT HIGHWAY # 7

DATE	OWRC	DELORO	HEALTH	OWRC	DELORO	HEALTH
Feb. 21	0	0	.03	.10	.09	.03
Mar. 8				.13		
Mar. 14	0	0	.03	.25	.24	.03
Mar. 23				.20		
Apr. 5				.05		
Apr. 11	.01	0	.03	.04	.15	.12
Apr. 12				.20		
Apr. 25	.01	0	.03	.05	.12	.04
May 9		0			.03	
May 31	0	0		.12	.14	
May 31				.08		
June 13	.07	.09	.03	.50	.24	.10
June 17				.30		
June 21				.30		
June 27	.15	.15		.40	.45	
July 8				1.00		
July 11	.38	.33	.03	1.14	1.17	.20
July 20				1.50		
July 25	.38	.18		1.14	.83	
July 28				0		
Aug. 3				1.0		
Aug. 8	.20	.30	.05	1.0	1.36	
Aug. 17				5.0		.47
Aug. 18				5.0		
Aug. 22		.65			6.82	
Sept. 5	.40	.22	.04	4.0	2.27	.10
Sept. 8				2.5		

continued .....

ARSENIC AS As (PPM)

1965 (cont'd) ABOVE PLANT — HIGHWAY # 7

DATE	OWRC	DELORO	HEALTH	OWRC	DELORO	HEALTH
Sept. 16				4.0		
Sept. 19	0	.06		.5	.68	
Sept. 21				6.0		
Oct. 3	.20	.09	.03	4.0	.39	.09
Oct. 17	.75	.02		.95	.24	
Oct. 21				.25		
Nov. 7	0	0	.03	0	.06	.03
Nov. 15				0		
Nov. 22	0	0		.10	.20	
Dec. 13	.01		.03			.20

ARSENIC AS As (PPM)

1964 ABOVE PLANT HIGHWAY # 7

DATE	OWRC	DELORO	HEALTH	OWRC	DELORO	HEALTH
Jan. 25	.10	.09	1.06	.69	.51	.20
Feb. 15	.04	0	.03	.24	.15	.04
Mar. 14	.03	0	.03	.04	.08	.04
Apr. 11	0	0	.03	.05	.12	.03
Apr. 25	0			.03		
Apr. 26		0			.12	
May 9	0	0	.03	.03	.15	.04
May 23	.02	0		.10	.09	
June 6	0	0	.03	.20	.15	.06
June 20		.03			.24	
June 24	.03		.17	.20		.20
July 4		.82			.51	
July 18	.03	.11		.59	.90	
Aug. 1	.25	.48	.39	.74	1.50	.79
Aug. 15		.70			1.59	
Aug. 29		1.06			4.23	
Sept. 12	.79	.98	.98	4.9	7.95	2.35
Sept. 26	7.1	1.06		4.2	6.00	
Oct. 9	1.36	1.14	.98	4.9	4.92	1.58
Oct. 24		1.36			4.16	
Nov. 7	1.36	.98		6.4	3.41	
Nov. 17				.32		
Nov. 22	0	.08	.45	.98	1.14	1.36
Nov. 24				0		
Dec. 6	0	.03	.03	.55	.24	.05

ARSENIC AS As (PPM)

1963 ABOVE PLANT HIGHWAY # 7

DATE	OWRC	DELORO	HEALTH	OWRC	DELORO	HEALTH
Jan. 12	0	0	.03	0	.09	.03
Feb. 16	0	0	.03	.10	.09	.04
Mar. 16	0	0	.03	.12	.09	.03
Apr. 6	0	0	.04	0	.03	.04
Apr. 13		0			.05	
Apr. 20	0	0		.11	.06	
Apr. 27		0			.06	
May 4		0			.08	
May 11	.01	0	.03	.15	.11	.14
May 18		0			.15	
May 25	.02	0		.08	.08	
June 1		0			.08	
June 8		0			.18	
June 15		.03	.03	.18	.18	.08
June 22		.06			.21	
June 29	.33	.30		.36	.30	
July 6		.48			.83	
July 13	.69	.60	.07	1.6	1.50	.47
July 21		.38			.75	
July 27		.53			1.20	
Aug. 3	.45	.53	.08	1.8	2.10	.59
Aug. 10		1.20			3.00	
Aug. 17		.53			2.40	
Aug. 24		.60			2	
Aug. 31		.60			2	
Sept. 7		.90			2.70	
Sept. 14	.04	.06	.03	1.5	2.60	.59

continued .....

ARSENIC AS As (PPM)

1963 (cont'd) ABOVE PLANT — HIGHWAY # 7

DATE	OWRC	DELORO	HEALTH	OWRC	DELORO	HEALTH
Sept. 21		.30			1.20	
Sept. 28		.53			1.40	
Oct. 5	.20	.53		1.3	.90	
Oct. 12		.60			1.00	
Oct. 19	.07	.08		.75	.38	
Oct. 26		.06			.45	
Nov. 2		.18			.83	
Nov. 9	.07	.09	.04	.59	.60	.04
Nov. 16		.03			.18	
Dec. 7		0			.24	
Dec. 14	.02	0	.03	.20	.18	.04

ARSENIC AS As (PPM)

1962 ABOVE PLANT ——————— HIGHWAY # 7

DATE	OWRC	DELORO	HEALTH	OWRC	DELORO	HEALTH
Jan. 13	0	.75	.03	.2	.24	.10
Feb. 10	0	.06	.03	0	.12	.03
Mar. 10	0	.06	.03	0	.24	.05
Apr. 7	0	0	.03	100	.08	.03
May 12	0	0	.03	.04	.15	.03
June 2	0	.03	.03	.3	.42	.04
June 16	0	.05		.3	.55	
July 7	0	.27	.10	.4	.73	.29
July 21	.5	.73		.4	1.4	
Aug. 4	0	.30	.03	1.0	1.2	.20
Aug. 18	.36	.23		1.3	2.4	
Sept. 8	1.5	1.50	.05	3.0	2.6	.38
Oct. 13	0	.07	.05	1.00	1.70	.79
Nov. 11	0	.02	.03	30	.27	.10
Dec. 9	0	0	.03	.4	.09	.04

ARSENIC AS As (PPM)

1961 ABOVE PLANT HIGHWAY # 7

DATE	OWRC	DELORO	HEALTH	OWRC	DELORO	HEALTH
Jan. 11		.15			.49	
Feb. 8		.27			.53	
Feb. 23			.98			2.05
Mar. 15		.09			.24	
Mar. 27			.75			3.80
Apr. 6			.03			
Apr. 11	0	0		.1		
Apr. 19	0	0	.36	.1	.18	.08
May 11	0	0	.06	.1	.15	.05
June 2	0	0	.03	.2	.18	.03
June 21	.04	.03		.2	.24	
July 5	.08	.06		.7	.49	
July 10			.03			.14
July 11	.14	.06		.4	.38	
Aug. 9	.19	.30	.05	.72	.74	.10
Aug. 23	.36	.90		4.2	2.5	
Sept 6	2.6	1.8	.33	2.8	2.6	.60
Sept. 20	1.6	1.8		2.5	3.3	
Oct. 4	3.0	2.4	.30	9.0	5.3	.69
Oct. 18	1.8	2.1		7.5	5.3	
Nov. 1	1.8	1.5	.90	9.0	4.2	1.97
Nov. 15	1.0			6.0		
Dec. 4	.10		.10	.5		.10
Dec. 16	.05			.6		

ARSENIC AS As (PPM)

1960 ABOVE PLANT HIGHWAY # 7

DATE	OWRC	DELORO	HEALTH	OWRC	DELORO	HEALTH
Jan. 21			.01			.30
Feb. 17			.01			.21
Apr. 21			.10			.25
May 5			.01			.20
May 10	0			.23		
May 31			.10			.60
June 23			.06			.20
July 18			.30			.30
July 28	1.2			3.0		
Aug. 23			.51			.70
Aug. 23			.90			1.36
Sept. 12			2.20			.98
Oct. 19			3.0			4.0
Nov. 4	2.4		2.4	4.8		
Nov. 7			1.59			9.0
Dec. 29			.10			.98

ARSENIC AS As (PPM)

1959 ABOVE PLANT HIGHWAY # 7

DATE	OWRC	DELORO	HEALTH	OWRC	DELORO	HEALTH
Jan. 14	0			0		
Jan. 21			.12			.51
Feb. 18			.12			.20
Mar. 18			.01			.10
Apr. 16			.01			.01
May 6	.03		.02	.13		.10
May 22			.05			.10
May 23				.39		
June 18			.20			.40
July 21			.48			2.53
Aug. 20			.90			3.60
Sept. 16			.70			2.20
Oct. 27			.90			2.05
Nov. 19			.10			.01
Dec. 28			.01			.10

ARSENIC AS As (PPM)

1958 ABOVE PLANT ——————— HIGHWAY # 7

DATE	OWRC	DELORO	HEALTH	OWRC	DELORO	HEALTH
Jan. 29			.01			1.67
Feb. 17			.01			.02
Mar. 27			.01			.01
Apr. 28			01			.01
June 2			.04			.04
June 20			.15			2.27
July 21			.53			8.86
Aug. 13	.20			17.4		
Aug. 18				58.0		
Aug. 22			1.09	12.1		28.4
Sept. 5				12.9		
Sept. 19			.60			4.05
Oct. 21			.80			.91
Dec. 9	.15			.91		
Dec. 18			.04			.60

ARSENIC AS As (PPM)

1957 ABOVE PLANT HIGHWAY # 7

DATE	OWRC	DELORO	HEALTH	OWRC	DELORO	HEALTH
Jan. 8			.01			.01
Jan. 25			.02			.02
Mar. 22			.02			.02
Apr. 18			.02			.03
May 3			.02			.02
May 31			.01			.01
July 5			.01			.01
July 19			.01			.01
Sept. 25			.01			.01
Nov. 8			.01			.01
Dec. 11			.02			.01
Dec. 24			.03			.01

ARSENIC AS As (PPM)

1956 ABOVE PLANT — HIGHWAY # 7

DATE	OWRC	DELORO	HEALTH	OWRC	DELORO	HEALTH
Jan. 6			.02			.01
Jan. 30			.02			.03
Feb. 29			.02			.01
Mar. 29			.01			.01
Apr. 20			.01			.02
June 22			.02			.02
June 25			.01			.02
July 20			.02			.03
Aug. 31			.01			.01
Nov. 16			.01			.07
Nov. 30			.01			.01

ARSENIC AS As (PPM)

1955

	ABOVE PLANT			HIGHWAY # 7		
DATE	OWRC	DELORO	HEALTH	OWRC	DELORO	HEALTH
Jan. 14			.02			.02
Feb. 15			.01			.03
Mar. 23			.01			.02
May 6			.01			.01
May 27			.01			.01
June 28			.02			.02
July 29			.01			.05
Aug. 23			.02			.03
Oct. 13			.02			.03
Nov. 3			.02			.01
Nov. 23			.02			.01

ARSENIC AS As (PPM)

1954 ABOVE PLANT HIGHWAY # 7

DATE	OWRC	DELORO	HEALTH	OWRC	DELORO	HEALTH
Jan. 21			0			0
Feb. 26			.01			0
Mar. 19			0			0
Apr. 15			0			0
May 17			0			.11
June 8			.02			.02
July 14			0			.10
Sept. 9			0			0.
Sept. 13			0			.02
Oct. 28			0			0
Nov. 17			0			.08
Dec. 17			.01			

ARSENIC AS As (PPM)

1953 ABOVE PLANT ——————— HIGHWAY # 7

DATE	OWRC	DELORO	HEALTH	OWRC	DELORO	HEALTH
Jan. 5			0			.07
Feb. 4			0			0
Feb. 27			.01			0
Mar. 19			0			.02
Apr. 1			0			.02
May 6			1.10			.04
June 3			0			0
July 2			0			0
Aug. 5			0			.06
Sept. 2			.19			.20
Oct. 7			.01			.03
Nov. 4			0			0

ARSENIC AS As (PPM)

1952 ABOVE PLANT HIGHWAY # 7

DATE	OWRC	DELORO	HEALTH	OWRC	DELORO	HEALTH
Feb. 15			.05			.08
Mar. 22			.03			0
Apr. 29			.03			0
May 21			0			0
June 25			0			0
July 15			.02			.4
Aug. 25			.06			1.50
Sept. 25			0			.17

ARSENIC AS As (PPM)

1951

DATE	ABOVE PLANT OWRC	ABOVE PLANT DELORO	ABOVE PLANT HEALTH	HIGHWAY # 7 OWRC	HIGHWAY # 7 DELORO	HIGHWAY # 7 HEALTH
Feb. 7			.05			.08
Mar. 6			.03			0
Apr. 25			.03			0
May 19			0			0
June 23			0			0
July 11			.02			.38
Aug. 22			.06			1.50
Sept. 22			0			.17
Oct. 29			0			.07

A P P E N D I X II

A Summary of the Monthly Average Arsenic Concentrations for Samples Collected at All Sampling Stations on the Moira River System

MOIRA RIVER

YEAR 1969

MILES FROM LAKE ONTARIO	JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.	LOCATION
.2													VICTORIA PARK
.7		.02	.03	.01		.03	.02	.04	.07	.04			HWY Nº 2 BRIDGE
1.5		.02	.03	.02		.02	.03	.04	.07	.04			SEWER EFFLUENT
3.1		.03	.03	.02		.03	.04	.06	.04	.05			CANIFTON BRIDGE
26.8													CHAPMAN'S BRIDGE
27.2		.03		.03		.02	.04	.08	.11	.07			STOCO LAKE OUTLET
28.7		.02	.04	.03		.02	.02	.07	.10	.06			STOCO BRIDGE
31.0		.04		.04		.04	.04	.07		.06			STOCO LAKE
31.2		.04	.04	.03		.04	.04	.05	.02	.05			TWEED
32.0				.02			.01			.02			CLARE RIVER
32.8				.02			.01			.02			SULPHIDE CREEK
37.7			.02	.01		.02		.04	.01				SKOOTAMATTA RIVER
39.0				.01									BLACK RIVER
43.4		.08	.08	.01		.11	.12	.36	.21	.22	.29		MOIRA LAKE
45.4										.02			DEER CREEK
49.6			.02	0		.01		.01	.01				DEER CREEK
57.6		.08	.06	.05	.14	.15	.16	.84	1.20	1.22	.52	.18	HWY Nº 7
63.7	0			0	.03	.02	.02	.10	.14	.52	0	.02	ABOVE PLANT
68.6													DOWNSTREAM OF MALONE

MOIRA RIVER

YEAR 1968

MILES FROM LAKE ONTARIO	JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.	LOCATION
.2													VICTORIA PARK
.7			.01	0	.01	.01	.01	.30	0		.02		HWY Nº 2 BRIDGE
1.5			.03	0	.01	.02	.01	.20	0		.02		SEWER EFFLUENT
3.9			0.	0	.01	.01	.01	.02	0				CANIFTON BRIDGE
20.8													CHAPMAN'S BRIDGE
27.2				0	.01	.01	0	.03	0		.03		STOCO LAKE OUTLET
29.7	0.	.11		0	.01	.02	0	.01	0		.05		STOCO BRIDGE
31.0											.02		STOCO LAKE
31.2	0.	0.		0	.01	.03	0	.02	0		.03		TWEED
32.0			.03	0			0						CLARE RIVER
32.8				0			.10						SULPHIDE CREEK
37.7			.01	0	0	.01	0	0	0		0		SKOOTAMATTA RIVER
39.0				0									BLACK RIVER
44.4	.05	.05	.06	.05	.06	.09	.10	.13	.12		.26		MOIRA LAKE
48.4													DEER CREEK
48.5			0	0	0	.01	0	.01	0		.02		DEER CREEK
57.6	.03	.07	.29	.10	.08	.26	.22	.97	.94	.56	.22		HWY Nº 7
59.7		.01	0	.01	.02	.02	.01	.15	.09	.16	.03		ABOVE PLANT
62.6													DOWNSTREAM OF MALONE

MOIRA RIVER

YEAR 1967

MILES FROM LAKE ONTARIO	JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.	LOCATION
.2													VICTORIA PARK
.7										0	0	0	HWY Nº 2 BRIDGE
1.3										0	0	0	SEWER EFFLUENT
3.0										0	0	0	CANIFTON BRIDGE
20.6													CHAPMAN'S BRIDGE
27.2			0	0	0	0				.06	0	.01	STOCO LAKE OUTLET
29.7	.02		.02	0	0	0			.04	0	0	0	STOCO BRIDGE
31.0													STOCO LAKE
31.2										.05	0	0	TWEED
32.0										0			CLARE RIVER
32.3										.05			SULPHIDE CREEK
37.7										0	0	0	SKOOTAMATTA RIVER
38.0										0			BLACK RIVER
44.4								.21		.19	.17	.04	MOIRA LAKE
45.4													DEER CREEK
46.0										0	0	0	DEER CREEK
57.8	.03	.06	.13	.05	.19	.29	.11	.48	.42	.50	.13	0	HWY Nº 7
58.7	.03	.04	.02	0	.01	0	.01	.10	.08		0	0	ABOVE PLANT
62.8													DOWNSTREAM OF MALONE

MOIRA RIVER

YEAR 1966

MILES FROM LAKE ONTARIO	JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.	LOCATION
.2													VICTORIA PARK
.7				0				.10					HWY Nº 2 BRIDGE
1.5													SEWER EFFLUENT
3.9								.04					CANIFTON BRIDGE
26.3													CHAPMAN'S BRIDGE
27.2							0	.10			.02	0	STOCO LAKE OUTLET
29.7							0	.06			.01		STOCO BRIDGE
31.0													STOCO LAKE
31.2			0					.04					TWEED
32.0								.01					CLARE RIVER
32.8								.02					SULPHIDE CREEK
37.7								.02					SKOOTAMATTA RIVER
38.0								.02					BLACK RIVER
44.4								.18					MOIRA LAKE
45.4													DEER CREEK
46.5								0					DEER CREEK
57.3	.75	.10	.18	.07	.05	.12	.24	2.00	1.55	2.00	2.30	.12	HWY Nº 7
58.7	0	.03	.02	0	.01	.02	.14	.66	.67	.36	.07	0	ABOVE PLANT
62.3													DOWNSTREAM OF MALONE

MOIRA RIVER

YEAR 19 65

MILES FROM LAKE ONTARIO	JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.	LOCATION
.2				.02		.04	.01		0				VICTORIA PARK
.7						.01	.01						HWY Nº 2 BRIDGE
1.5			.01				.01	.05	0				SEWER EFFLUENT
3.3							.01	.03	0				CANIFTON BRIDGE
15.6			.06	.03	0	.02	0		0				CHAPMAN'S BRIDGE
17.2													STOCO LAKE OUTLET
20.7			.06	.02		.04	.01	.13	0				STOCO BRIDGE
31.0													STOCO LAKE
31.2							.03	.10	.01				TWEED
34.0													CLARE RIVER
36.0													SULPHIDE CREEK
37.7													SKOOTAMATTA RIVER
38.0													BLACK RIVER
41.4			.03	.13	.08	.07	.10	.08	.03		.20		MOIRA LAKE
43.4													DEER CREEK
48.5													DEER CREEK
57.6		.10	.20	.08	.10	.38	.96	3.00	3.40	1.73	.03		HWY Nº 7
59.7		0	0	.01	0	.11	.38	.20	.20	.48	0	.01	ABOVE PLANT
62.6			0	0	0	0							DOWNSTREAM OF MALONE

MOIRA RIVER

YEAR 1964

MILES FROM LAKE ONTARIO	JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.	LOCATION
.2				.02		.04	.01	.02	0				VICTORIA PARK
.7													HWY Nº 2 BRIDGE
1.3							.02	.01	0				SEWER EFFLUENT
3.9							.02	.04	.04				CANIFTON BRIDGE
23.3							.02	.03	.02				CHAPMAN'S BRIDGE
27.2													STOCO LAKE OUTLET
29.7													STOCO BRIDGE
31.0							.02	.03	.04				STOCO LAKE
31.2							.01	.02	.01				TWEED
32.0													CLARE RIVER
32.8													SULPHIDE CREEK
37.7													SKOOTAMATTA RIVER
39.0													BLACK RIVER
44.4							.03	.06	.11		.12		MOIRA LAKE
45.4													DEER CREEK
46.5						.01	0						DEER CREEK
47.3	.69	.24	.04	.04	.07	.20	.59	.74	4.70	4.90	1.90	.55	HWY Nº 7
50.7	.10	.04	.03	0	.01	.02	.03	.25	.79	1.36	.68	0	ABOVE PLANT
52.6											.15		DOWNSTREAM OF MALONE